

Report from the Greenhouse Gas Working Group of the State Advisory Board on Air Pollution

Executive Summary

Greenhouse gases (GHG) in the atmosphere trap heat and thereby insulate the Earth, keeping it warm enough to support life as we know it. Water vapor and carbon dioxide (CO₂) are the most important of these gases, while methane, ground-level ozone, nitrous oxide and a few synthetic gases are also important. There is strong consensus among atmospheric scientists that human activities are responsible for much of the rapid increase in atmospheric concentrations of these GHGs. Also, there is a strong scientific consensus that the average temperature of the Earth has risen more than one degree Fahrenheit over the past century with most of this increase occurring over the past three decades, with the Arctic and Antarctic warming more than lower latitudes. With a few exceptions, nearly all Earth scientists believe that there is a strong causal relationship between the rapidly increasing concentration of GHGs in the atmosphere and the rising global temperature. This phenomenon is known as global warming and can have profound consequences, some of which are now observable because of the past emissions of greenhouse gases, mostly CO₂.

International efforts to combat global warming have been underway since 1992 with the UN Framework Convention on Climate Change. The US federal government, having ratified the UNFCCC, has not taken meaningful steps towards developing or implementing an effective national program. Numerous states and a number of cities have taken steps to control CO₂ emissions using a variety of regulatory approaches and incentives. One of these efforts is a regional agreement among eight northeastern states.

Global warming is the best explanation that scientists have for a number of recent changes such as melting of mountain glaciers, polar ice caps, arctic permafrost, ice shelves, and sea pack ice over the past several decades. Global warming is also believed to be a leading cause for the observed changing regional precipitation patterns, floods and draughts; changing migration patterns for birds and insects; and ecosystem disturbances, especially for forests. Warming oceans are an important cause of major declines in coral reefs worldwide, and the observed effect of CO₂ on ocean acidity could be a profound threat to the productivity of ocean fisheries over the next half century.

As temperatures increase over the next decades, human and agricultural diseases and parasites may move into areas where they have never before been found. Furthermore, warming of the oceans and melting of polar ice caps and glaciers will cause sea level to rise to levels far exceeding those previously experienced by humans. This risk is of special concern in Virginia with a substantial coastline and important commercial, residential and recreational interests at or near the coast and Chesapeake Bay. The U.S. is at risk to a number of other consequences of further global warming, while some of these are of particular concern to Virginia.

A recent important economic study, the Stern Report, concludes that investing comparatively modest resources (about 1% of GDP) to combat global warming in the near term will be much less costly to society than the costs (5% to 20% of GDP) of damages from global warming by the second half of this century. The ongoing cumulative buildup of GHGs in the atmosphere will persist, depending on the gas, over the time scale of several decades to centuries. Thus, measures to slow and eventually

halt this buildup will be more effective if implemented sooner, and the total unavoidable economic cost (implementation costs plus damages) will be lower.

The principle greenhouse gas from human activities is CO₂, largely because emissions of CO₂ are many times greater than any other greenhouse gas. This trend is true throughout the world, especially in the industrialized world. The US is responsible for about 25% of global CO₂ emissions, and CO₂ from burning fossil fuels accounts for about 80% of US greenhouse gas emissions. Thus, the emission of CO₂ is the measure of contribution to global warming, or the measure of slowing global warming. The only two ways to address the problem of global warming caused by GHG are reducing GHG emissions (principally CO₂) or removing atmospheric CO₂, a process known as sequestration.

In Virginia, the CO₂ produced per person or per dollar of commerce is lower than the US average, in part due to nuclear power generation that produces no CO₂ during electricity generation. However, CO₂ emissions per person in Virginia are still substantially above those found in most other industrialized countries. Controlling global warming will require reducing the CO₂ emission and increasing its sequestration, both of which can be accomplished in Virginia. Reducing CO₂ emissions can be achieved with increased efficiencies in various sectors of the economy.

Improvements in energy efficiency have great potential to reduce CO₂ emissions, as demonstrated over the last 30 years with improvements in building construction, appliance performance, vehicle fuel efficiency, etc. The US Department of Energy estimates that efficiency improvements could save enough energy to fully offset the expected increase in demand (19%) in the coming decades. The added advantage of energy efficiency improvements is the ability to rapidly implement many efficiency measures. Energy efficiency improvements will not, however solve the basic problem of increasing CO₂ emissions. What is needed is energy production with vastly reduced CO₂ emissions, or CO₂ emission-free energy production.

The transportation sector is one of the most promising areas of CO₂ emissions reductions because transportation accounts for 40% of CO₂ emissions nationwide and in Virginia. Great potential efficiency improvements lie in auto efficiency standards (corporate auto fuel efficiency or CAFÉ), in public transportation and in measures that greatly reduce vehicle miles traveled. Hydrogen fuel cell driven cars are a future possibility, as are vehicles that use ethanol, both of which have the possibility of reducing emissions of CO₂ and other air pollutants.

Nuclear energy currently provides about 36% of the electricity generation in Virginia. GHG emissions from nuclear generating facilities is limited to those produced by manufacturing the facility, fuel treatment and processing and ancillary activities, rather than the daily operations.

Renewable energy (wind, solar, biomass, hydropower, ocean and geothermal) offers a great deal of promise for providing CO₂-free energy sources in Virginia. According to a recent Department of Energy study, Virginia could produce as much or more electricity than currently generated in Virginia in 5-15 years. Many states have sought to increase the extent of renewable energy use by adopting renewable portfolio standards (RPS) at the state level. Some states are using RPSs as a means of encouraging the development of the alternative energy sector in their economic development strategies.

Fossil fuels (oil, gas, coal) comprise the major source of current energy production in the US and Virginia, and result in the greatest CO₂ emissions annually. Many years and substantial technological development are anticipated before this picture changes to CO₂ free energy generation. The biggest advance in the near term is advanced coal gasification with carbon capture, a technology that uses coal as the fuel and the CO₂ is captured, pressurized and injected deep into the Earth.

CO₂ may also be sequestered from the atmosphere by biological means in forests and grasslands. Replanting and conservation of forestland and grassland is one of the options open to Virginia to capture and store CO₂ in plant tissue.

Various other methods can make contributions to increasing energy efficiency, reducing energy demand or reducing GHG emissions. Some of these options are capture of landfill gas as a fuel, increasing green space to reduce temperatures and energy demand, changing land use practices to improve agricultural efficiencies and reduce GHG losses, among others. Little attention has focused on methane capture from agricultural activities, an area that could provide measurable progress.

The GHG Work Group did not come to consensus on policy options, thus we present a range of policies to address GHG emissions. These options include conducting inventories, providing incentives for CO₂ reductions, adopting state government procurement standards and preferences, regulating and/or taxing CO₂ producing systems, creating a cap and trade system and supporting research and development of new technologies. A portfolio of effective policy options will be required to halt the buildup of GHGs in the atmosphere. An efficient strategy to work towards this end might include a strong focus on reducing methane emissions in the short term, while simultaneously developing and implementing measures to control CO₂ emissions over the longer term. Controlling emissions of both gases will be necessary to ultimately halt global warming.